Once More about Bases of Relativity

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Abstract: The particular and interesting cases of Special Relativity have been discovered. The role of the generalized quaternions is such a phenomenon.

We have:

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \tag{1}$$

$$v = \frac{dx}{dt}$$

$$x = x_A + ix_B$$

$$t = t_A + it_B$$

We have the next velocities:

$$v = \frac{d_x}{d_t} = \frac{x_A + ix_B}{t_A + it_B}$$

We put it into (1) and we have the formula monster.

Moreover:

$$v_1 = \frac{dx_A}{dt_A}, \quad v_2 = \frac{dx_B}{dt_B}, \quad v_3 = i\,\frac{dx_B}{dt_A}, \quad v_4 = \frac{1}{i}\,\frac{dx_A}{dt_A} .$$

If the velocities are constant, we have:

$$v_g = \frac{x_A + ix_B}{t_A + it_B} \tag{1}$$

$$v_1 = \frac{x_A}{t_A} \quad \text{(2a)}, \quad v_2 = \frac{x_B}{t_A} \quad \text{(2b)}, \quad v_3 = \frac{1}{i}\,\frac{x_A}{t_B} \quad \text{(2c)}, \quad v_4 = \frac{x_B}{t_B} \quad \text{(2d)}$$

It is seen that equations (2b) and (2c) arise if we put in the formula (1) respectively $x_A = 0$ and $t_B = 0$ or $x_B = 0$ and $t_A = 0$.
So equations (2) are the formulas resulting from (1) – its particular case.

So in formulas (2b) and (2c) it is necessary to take under consideration the complex part because of the above implication.

The motion in the plane in which the time coordinate is complex and space coordinate is real or the time coordinate is real and pace coordinate is complex – means an existence of the complex velocity.

Then formula (1) has the shape:

$$m = \frac{m_0}{\sqrt{1+\frac{v^2}{c^2}}} \tag{3}$$

Discussion of formula (3):

- Here there is not the limitation as far as the velocity c is concerned
- Both members of the formula can be simultaneously multiplied by i , we have then im and im_0 and $\sqrt{1-\frac{|v|^2}{c^2}} \in R$. There is not the discrepancy as in ( ) because there are other assumptions here.
- Both masses can be essentially complex (not only $M = i|M_0|$ but $= M_1 + iM_2$, $M_1 \neq 0$.
- The solutions with the masses m and m_0 both complex and real are described by equation (1) and (3).
- $|v^2|$ may be negative in the case of certain generalized quaternions.
- The square root in formula (3) may be both positive and negative.
- Equation (3) describes the only case when the real mass particles may move with the velocity bigger than the velocity c ($v > c$), but the mass of such a particle decreases very fast with the velocity emitting radiation.

The objects moving along only one complex axis – when the mass of this particle is expressed by formula (3) – emit the complex radiation with the growing frequency tending to the constant limit.

Fig. 1